

A MORPHOLOGICAL COMPARISON OF TWO HARRIER POPULATIONS

by

William C. Scharf
Division of Science and Mathematics
Northwestern Michigan College
Traverse City, Michigan 49684

Frances Hamerstrom
College of Natural Resources
University of Wisconsin/Stevens Point
Plainfield, Wisconsin 54966

Introduction

Harriers have been studied intensively in two separate study areas: *Circus c. cyaneus* in Orkney, Scotland, latitude 59° N (Balfour, 1957, 1962, 1970; Scharf, 1968; and Scharf and Balfour, 1971) and *C. c. hudsonius* in central Wisconsin, latitude 43° N (Hamerstrom, 1963, 1968, 1969; Hamerstrom and Wilde, 1973, and Schmutz and Schmutz, 1975). Both populations are migratory, but both were studied during the breeding season, which provided an excellent opportunity for comparison of two geographically separate breeding populations (demes). Comparisons were not made with findings in the existing literature since the latter have dealt with composites of breeding, migrating, and wintering birds.

In all, 284 birds were weighed, measured, and otherwise examined during the course of banding: Scharf and Balfour trapped 55 breeding hen harriers near 54 nests during 1967 and 1968; Hamerstrom and co-workers trapped 130 breeding American harriers near 139 nests from 1960 to 1972; and a separate sample of 99 Wisconsin migrants was handled. Our sample size varies because occasionally we failed to take a measurement.

Plumage

Differences in plumage are not great, but are consistent within each population. The bars on the tail of adult male *cyaneus* are paler than those of *hudsonius*, and the female's plumage is browner, both dorsally and ventrally.

Wing Length

At first we included migrants in our Wisconsin sample. We were puzzled to find that migrant adult males and females alike had slightly longer wings than the breeders. The migrants were all trapped in spring, for the most part in April, and most of the breeding birds were trapped about three months later—usually in July. We attribute the difference to feather wear. It may also be true that individuals of the central Wisconsin deme were slightly smaller than those passing through the area.

In either case it seems best to limit our comparisons to the breeding populations. For these samples we used trapping methods which were essentially comparable in the two areas and which were specific for breeders. All harriers were caught while defending their nests against an owl (Hamerstrom, 1963; and Scharf, 1968), with the exception of 10 miscellaneous catches, also known to be breeders. Furthermore, we have excluded breeding juveniles, using Hamerstrom's (1968) criteria.

Our technique for measuring the flattened wing was to strive for the maximum measurement. We placed the folded wing parallel to the rule and stretched it from the tip of the longest primary to the bend of the wing, simultaneously pressing on the distal end of the metacarpel to bring the phalanges parallel to the rule; meanwhile the wing was pressed flat to get rid of the curvature of the primaries. On birds larger than Kestrels (*Falco sparverius*), this measurement is more easily taken by two people. When working alone we held the tips of

the primaries in position on the rule with our toes. Chords were measured in the usual manner: the folded wing was placed on the rule to allow for the natural curvature of the feathers.

It is important, we believe, to mention that we were aware of the need to standardize our measuring technique. During the summer of 1964 Scharf and Hamerstrom worked together in the field on these measurements, and each in turn taught his co-workers to measure in the same manner.

Measurements of wing length for both populations are shown in table 1. Within each population there is an obvious difference in wing length between the sexes. But within each sex, there is only a small standard deviation on either side of the mean, indicating a high degree of homogeneity within each deme (figure 1). Between Orkney and Wisconsin populations, moreover, there is a significant difference in wing length. Orkney males average 19.0 mm shorter (flattened) than Wisconsin males, and Orkney females average 20.6 mm shorter than those captured in Wisconsin. The corresponding chord measurements showed Orkney males 14.4 mm shorter and Orkney females 15.4 mm shorter.

It has been difficult in the past to compare the wing lengths of *cyaneus* and *hudsonius* on a continental basis because Europeans tend to measure the flattened wing (Witherby et al., 1943) and Americans the chord (Friedmann, 1950). We plotted flattened lengths against chord lengths for our *cyaneus* and *hudsonius* populations (figure 2). We find the figure useful for conversion if one has only one type of measurement and seeks the other. The proportionate ratio of flattened to chord in figure 2 may not hold true for dried museum skins where the dimensions may have changed—i.e., the upper wing shrinks or becomes less flexible in the dried skin, hence the length is reduced (Mueller and Berger, 1968). The straight-line relationship in figure 2 can be calculated from linear regressions. Significance tests show that mean corrections would be less than 1 mm at the 95 percent confidence level. This implies that groups of 50 or more measurements would lie within 1 mm of the respective converted chord of flat length.

Weight

The Orkney birds were weighed on Pesola spring scales; a beam balance was used in Wisconsin. Because nearly all birds were trapped when defending their nests, almost none had food in the crop. We therefore made no correction for possible crop contents. Weights are given in table 2 for comparison.

We found so much variation in both Wisconsin and Orkney weights that they do not seem particularly useful for comparison. Our differences in means are not statistically significant ($p > .05$). Although our samples were all taken during the breeding season, there was considerable year-to-year variation in mean weights of both sexes: Wisconsin females ranged 70 g (from 481 to 551 g) and males 43 g (from 305 to 348 g). In Orkney, females ranged 16 g (from 510 to 526 g) and males 19 g (from 337 to 356 g).

Egg Color

Balfour (1962) stated that the eggs of harriers in Orkney are blue when laid and turn white in about a week or less. Hamerstrom (1969) found that *hudsonius* eggs also turn from blue to white, but 2-3 days after laying. We suspect that eggs bleach more quickly under sunny Wisconsin skies than on the misty moors of Orkney.

Eye color

Young female harriers have chocolate-brown irises that change to yellow with age.

Judging the percent of brown in the iris is subjective, but Scharf and Hamerstrom examined live birds together and with their co-workers to standardize their evaluations. In addition, Scharf maintains a series of color transparencies of the Orkney birds for reference.

The rate of change, however, is not the same. Orkney female harriers retain their dark iris color longer than those in Wisconsin. Hamerstrom (1968) showed that only first-year females had irises that were more than 50 percent brown. (In 1970 she trapped an exception: a brown-eyed female, aged 2). Two of her three second-year Wisconsin females had attained irises that were almost wholly yellow. Balfour (1970) reported the brown irises retained through ages 3 to 4 years, and Scharf has record of one known-age Orkney female of 5 years with a brown iris.

It at first appeared that the age composition of the two populations was similar, on the basis of eye color of the trapped sample. In Orkney, 53.4 percent of the nesting females trapped had brown irises; in Wisconsin the figure was 58 percent. However, some of the Orkney brown-eyed individuals were as old as 5 years, whereas only one of the Wisconsin females with brown irises was over one year old. This striking difference in actual age composition of the two populations is an example of the care that must be exercised in using eye color in population studies.

Summary and Conclusions

We compared wing lengths, weights, egg color, and eye color of two harrier populations: *Circus cyaneus hudsonius* in central Wisconsin and *C. c. cyaneus* in Orkney, Scotland. As the wings of Wisconsin adults during the breeding season average slightly shorter than those of spring migrants (we suspect feather wear), we base our comparisons on adults during the breeding season. Each deme is remarkably homogeneous for the parameters studied, except for weights. Wing lengths differed significantly between sexes and demes. We suspect that Orkney eggs hold their blue color longer, but further field work needs to be done. Irises of Orkney females tend to turn yellow later in life than those of Wisconsin females.

We show that a significant difference exists between chord and flattened-wing measurements and have presented a practical method of comparing chord and flattened wing, making it possible to compare measurements as given in the literature.

Considering only our comparisons, the suggestion by Brown and Amadon (1968, Vol. 1, p. 392) that the two forms from Eurasia and North America may be distinct species seems to be warranted.

Acknowledgments

We are grateful to the following people for the help indicated: Donald R. Thompson, Wisconsin Department of Natural Resources, statistical analysis; Edward Balfour, the Royal Society for Protection of Birds, nest finding and measuring in Orkney; John A. Hart, field work and data extraction in Wisconsin; F. N. Hamerstrom, Jr., and Ruth L. Hine, critical reading and data checking; and numerous "gaboons" acknowledged elsewhere by Frances Hamerstrom. Dean Amadon, Harvey I. Fisher, Ernst Mayr, and Robert W. Storer kindly commented on earlier drafts of the manuscript.

Scharf was supported by the Frank M. Chapman Memorial Fund of the American Museum of Natural History and by the Royal Society for Protection of Birds while in Orkney, Scotland. Hamerstrom has received aid from the Frank M. Chapman Memorial Fund for her studies in Wisconsin. Northwestern Michigan College allowed use of its facilities in producing the manuscript.

Literature Cited

- Balfour, E. 1957. Observations on the breeding biology of the hen harrier in Orkney. *Bird Notes* 27(6-7):177-183, 216-224.
- . 1962. The nest and eggs of the hen harrier in Orkney. *Bird Notes* 30(3):69-73.
- . 1970. Iris colour in the hen harrier. *Bird Study* 17:47.
- Brown, L. and D. Amadon. 1968. *Eagles, hawks, and falcons of the world*. Vol. 1. New York: McGraw-Hill.
- Friedmann, H. 1950. Birds of North and Middle America, part 11. *U.S. Nat. Mus. Bull. No.* 50.
- Hamerstrom, Frances. 1963. The use of Great Horned Owls in catching Marsh Hawks. *Proc. XIII Int. Ornith. Cong.* pp. 866-869.
- . 1968. Ageing and sexing harriers. *Inland Bird Banding News* 40:43-46.
- . 1969. A harrier population study. In *Peregrine Falcon populations, their biology and decline* (J. J. Hickey, ed.). Madison: University of Wisconsin Press. pp. 367-383.
- Hamerstrom, Frances, and Deann Wilde. 1973. Cruising range and roosts of adult harriers. *Inland Bird Banding News* 45:123-127.
- Mueller, H. C., and D. D. Berger. 1968. Sex ratios and measurements of migrant Goshawks. *Auk* 85:431-436.
- Scharf, W. C. 1968. Improved techniques for trapping harriers. *Inland Bird Banding News* 40:163-165.
- Scharf, W. C., and E. Balfour. 1971. Growth and development of nestling hen harriers. *Ibis* 113:323-329.
- Schmutz, J. K. and Sheila Schmutz. 1975. Primary molt in *Circus cyaneus* in relation to nest brood events. *Auk* 92:105-110.
- Witherby, H. F., F. C. R. Jourdain, N. F. Ticehurst, and B. W. Tucker. 1943. *The handbook of British birds*. Vol. 3. London: Witherby.

Table 1. Comparison of adult breeding harriers in Orkney and Wisconsin: flattened wing versus chord (in mm).

	Flattened			Chord		
Male	N	Range	Mean	N	Range	Mean
<i>hudsonius</i>	39	334-370	(351.3)	38	325-361	(341.4)
<i>cyaneus</i>	12	322-340	(332.3)	14	316-335	(327.0)
Female						
<i>hudsonius</i>	66	376-416	(393.7)	66	361-409	(382.0)
<i>cyaneus</i>	36	358-384	(373.1)	39	357-379	(366.6)

Orkney measurements are significantly shorter than Wisconsin: males, $t=7.72$, 49 df, $p < .01$; females, $t=11.8$, 100 df, $p < .01$.

Table 2. Comparison of adult breeding harrier weights (in g): Orkney and Wisconsin.

	Male			Female		
	N	Range	Mean	N	Range	Mean
<i>cyaneus</i>	15	298-372	(367.4)	42	473-595	(529.9)
<i>hudsonius</i>	44	304-363	(334.0)	61	463-591	(515.8)

Differences are not significant ($p > .05$).

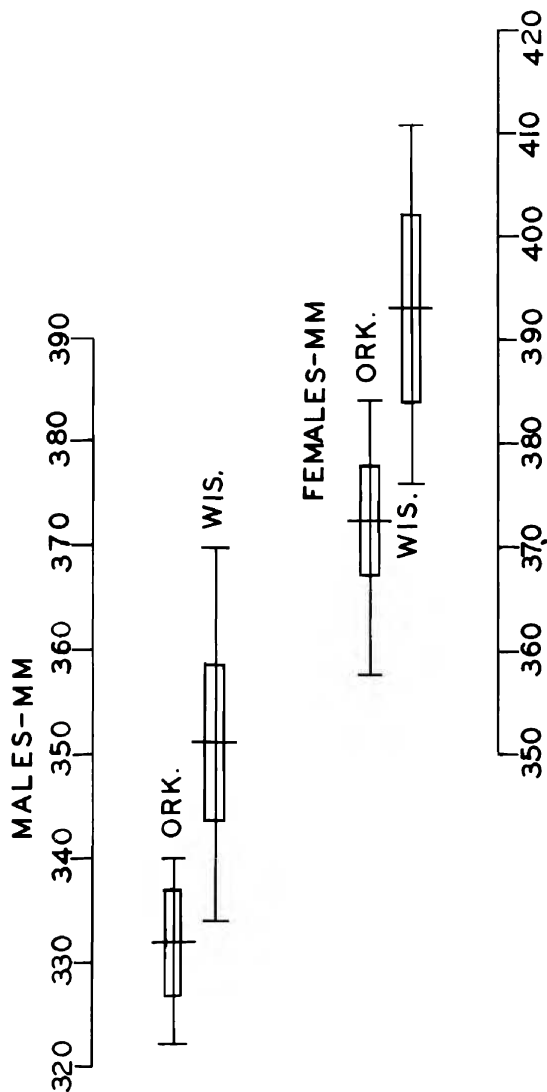


Figure 1. Flattened wing lengths, by sex, of two breeding adult harrier populations. Vertical bars indicate range and mean; blocks indicate ± 1 S.D. Orkney measurements are significantly shorter than Wisconsin: males, $t=7.72$, 49 df, $p<.01$; females, $t=11.8$, 100 df, $p<.01$.

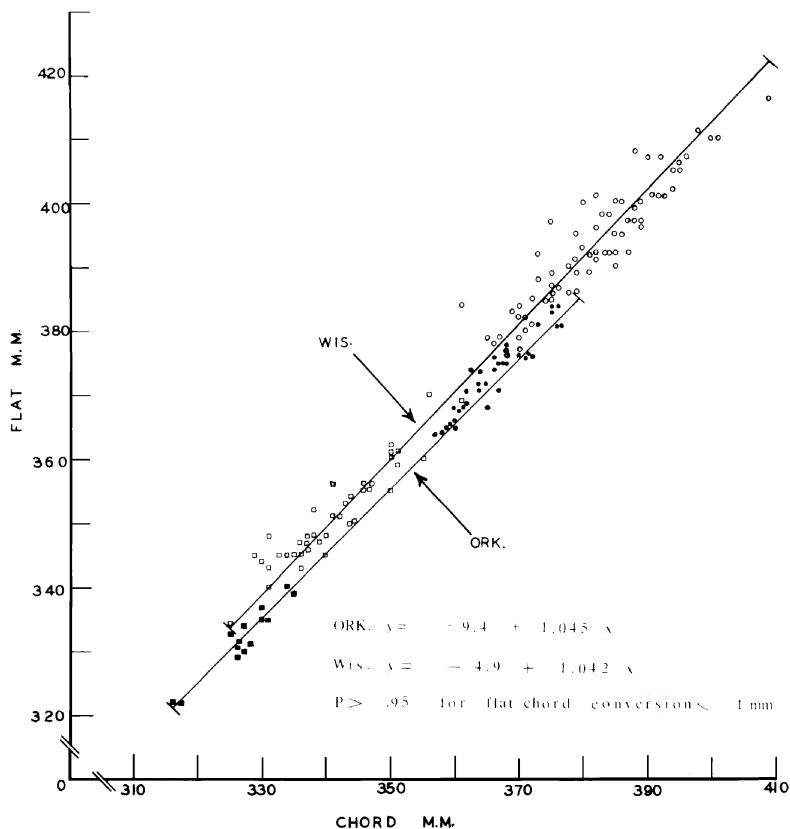


Figure 2. Comparison of flattened and chord measurements of wings of breeding adults of two harrier populations. Solid squares represent Orkney males; dots, Orkney females. Open squares represent Wisconsin males; circles, Wisconsin females. Lines represent regression calculation using extremes of X (bar) to calculate Y for each population. Difference between regressions not significant $p > .05$.